SECTION 22 0813

TESTING PIPING SYSTEMS

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LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the ESM Mechanical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within “stars” during editing.

NOTE: This specification is applicable only for systems that the test pressure does not exceed 150 psig with the exception of natural gas and refrigerant piping test specified herein. For systems greater than 150 psig, follow nationally recognized codes (ASME B31 codes), LIR/LIG 402-1200-01, or consult with the LANL Pressure Safety Officer.

Specification developed for ML-3 / ML-4 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure testing [and holiday testing] of the following systems:

1. Fire protection piping.
2. Plumbing piping (sewer lines, water lines, rainwater lines).
3. Natural gas piping.
4. Compressed air piping.
5. Instrument air piping.
6. Hydronic piping.
7. Steam and condensate piping.
8. Steam and condensate steel pre-insulated conduit system.
9. Refrigerant piping.
10. Vacuum piping.

11. Hazardous waste and vent double wall containment piping (gravity system).

12. Laboratory gas piping.

13. Holiday testing (buried coated steel piping).

1.2 CONTRACTOR REQUIREMENTS

A. Notify LANL Construction Inspector at least 24 hours (1 working day) in advance to witness piping test.

B. For discharge requirements of water used for pressure testing comply with Section 01 3545, Water Discharge Requirements.

C. Notify LANL Construction Inspector immediately in the event of any accidental discharge.

1.3 CONSTRUCTION INSPECTOR REQUIREMENTS

A. For discharge requirements of water used for pressure testing comply with Section 01 3545, Water Discharge Requirements.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 3300, Submittal Procedures:

1. Pneumatic test plan for approval that includes:

a. Material of construction

b. Design pressure

c. Test pressure and duration of test

d. Test medium and method of achieving the test pressure

e. Certification on calibration of pressure gauges

f. Method to exclude personnel from the area containing the system to be tested.

g. Over pressurization protection/prevention: Device make/model number, certification, pressure relief set point, point of installation in system.

2. Test Reports: Submit test procedures and test results within 10 working days of successful test.

PART 2 PRODUCTS

2.1 MATERIALS

A. Furnish instruments, equipment, material and labor necessary to conduct tests.

B. Calibrate testing equipment at reasonable intervals with devices of accuracy traceable to National Institute of Standards and Technology (NIST).

C. Use pressure chart recorders that are dead weight calibrated and certified within 30 days prior to each pressure test

D. Test gauges used in conducting test shall be in accordance with IAPMO UPC.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Piping being tested shall remain exposed until LANL Construction Inspector has approved piping test.

B. Trenches may be backfilled between joints before testing to prevent movement of pipe during testing. Ensure that thrust blocks are sufficiently hardened before testing.

C. Piping being tested shall not leak nor show any loss in test pressure for duration specified unless otherwise noted.

D. Where portion of piping system is to be concealed before completion, the portion shall be tested separately as specified for the entire system.

E. Ensure piping supports are in place.

F. Isolate system gages, sensors, etc., from pressure tests so instruments and devices are not damaged. Test pressure shall not exceed the maximum allowable test pressure for any vessel, pump, valves, or other component in the system.

G. Hydrostatic (Water) Testing:

1. Use potable water as test medium. Do not fill system until the LANL Construction Inspector has approved the source of water supply.

2. Provide vents at high points to release trapped air while filling system.

3. Provide drains at low points for complete removal of test liquid.

4. Drain system if there is a potential for freezing, i.e., no heat in building, coil in outside air stream, or other similar situations.

H. Pneumatic (Air) Testing:

1. Use clean dry air as the test medium.

2. Barricade the area around the system to be tested.

3. Prior to application of full air test pressure, apply a preliminary test of not more than 10 psig to reveal possible major leaks.

4. After preliminary test, raise pressure in stages not more than 25 percent up to full test pressure, allowing at least 10 minutes for equalization of strain and detection of major leaks at each intermediate stage. Hold final test pressure for time specified.

I. If leaks are found, they shall be eliminated by tightening, repair, or replacement, as appropriate and test repeated until no leakage is found.

3.2 PRESSURE TESTING

A. Fire Protection Piping:

1. Below Grade: Test with water at 200 psig for 2 hours.

2. Above Grade: Test with water at 200 psig for 2 hours per NFPA 13.

B. Plumbing Piping:

1. Sanitary Waste and Vent Piping Within Building to Building Wall:

a. Test with water in accordance with the IAPMO UPC to a minimum of 10 foot head of water. Keep water in system for at least 1 hour before inspection starts.

b. Acceptable Alternate: Test with air at 5 psig and hold pressure for at least 1 hour.

2. Sanitary Sewer Piping Beyond Building Wall: Completely fill system with water and let stand for at least 1 hour before inspection starts, then visually inspect to ensure that all joints are tight.

a. Test with water in accordance with the IAPMO UPC to a minimum of 10 foot head of water. Keep water in system for at least 1 hour before inspection starts.

b. Acceptable Alternate: Test with air at 5 psig and hold pressure for at least 1 hour

3. Sanitary Sewer Force Main: Test with water at [ ] psig for 4 hour.

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Test force main piping to 1.5 times operating pressure, 25 psig minimum.
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4. Potable Water Inside Building to Site Main: Test with water at [ ] psig for 4 hours.

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Test potable water piping to 1.5 times operating pressure, 100 psig minimum.
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5. Nonpotable Water: Test with water at [ ] psig for 4 hours.

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Test nonpotable water piping to 1.5 times operating pressure, 100 psig minimum.
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6. Rainwater Piping:

   a. Rainwater Piping Inside Building to 5 Feet Outside Building: Test with water in accordance with the IAPMO UPC to a minimum of 10 foot head of water. Keep water in system for at least 1 hour before inspection starts. Acceptable Alternate: Test with air at 5 psig and hold pressure for at least 1 hour.

   b. Rainwater Piping Beyond 5 feet of Building: Completely fill system with water and let stand for at least 1 hour before inspection starts, then visually inspect to ensure that all joints are tight.

C. Natural Gas Piping:

1. Operating Pressure to 5 psig: Test with air or inert gas at 60 psig for 8 hours.

2. Operating Pressure Greater than 5 psig to 100 psig: Test with air or insert gas at 160 psig for 24 hour. Bring pressure to 160 psig and equalize to ambient temperature before starting pressure test; repressure as necessary to attain 160 psig. Record test with a continuous (24 hour) calibrated, dead weighted, pressure recording chart. Recorded pressure line shall be continuous, even and virtually “straight” without abrupt glitches, jogs or changes. Pressure line shall return to its starting position pressure at end of 24 hour period.

D. Compressed Air: Test with air at [ ] psig for 4 hours.

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Test compressed air piping to 1.25 times operating pressure, 100 psig minimum.
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E. Instrument Air: Test with air at [ ] psig for 4 hours.

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Test instrument air to 1.25 times operating pressure, 50 psig minimum.
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F. Hydronic Piping (heating hot water, chilled water, tower water, condenser water, make-up water and equipment drains): Test with water at [ ] psig for 4 hours.

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Test hydronic piping to 1.5 times operating pressure, 100 psig minimum.
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G. Steam and Condensate Service Piping: Test with water at [ ] psig for 4 hours.

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Test steam and condensate piping to 1.5 times operating pressure, 100 psig minimum.
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H. Steam and Condensate Distribution Piping Systems:

1. Distribution Piping: Test with air or inert gas at 150 psig minimum for 4 hours

2. Preinsulated Conduit Systems: Outer steel casing, test with air at 15 psig for 4 hours or as otherwise specified in manufacture's written instructions.

I. Refrigerant Piping:

1. Test in accordance with the Uniform Mechanical Code (IAPMO UMC).

2. Pressure test with dry nitrogen mixed with a trace of halocarbon (HCFC-22) gas for 24 hours. Test the high and low side of each system at not less than the lower of the pressure noted in the IAPMO UMC or the pressure relief valve. Record test with a pressure-recording chart and check system with an electronic halogen leak detector or ultrasonic leak detector.

a. Do not use oxygen, acetylene, or other flammable/combustible gases or gas mixtures for leak testing.

b. 40 CFR 82.156 (b)(I)(B) prohibits use of refrigerants for leak testing. It does allow the use of trace quantities of HCFC-22 as a tracer gas.

3. After successful completion of nitrogen test, remove pressurization gas and evacuate system to 1 mm Hg. (1Torr or 1000 microns) or less to remove moisture and non-condensables. After 30 minutes, if the vacuum level has not risen to no higher than 2.5 mm Hg. (2.5 Torr or 2500 microns), the leak rate is acceptable. Check system with an electronic manometer or thermocouple gauge.

4. After successful completion of vacuum test, charge piping with system refrigerant. If start up is not within 24 hour, temporarily pressurize to 5 psig with system refrigerant.

5. Provide a dated test report to the LANL Construction Inspector for systems containing 50 pounds or more of refrigerant. Include in report the name and number designation of refrigerant used and the field pressure test applied to the high and low side of the system. The installer shall sign the test report.

J. Vacuum Piping: Evacuate to 1mm Hg. (1 Torr or 1000 microns) measured with an electronic manometer or thermocouple gauge. After 2 hours, if vacuum level has risen to no higher than 2.5 mm Hg. (2.5 Torr or 2500 microns), the leak test is acceptable.

K. Hazardous Waste and Vent Double Wall Containment Piping - Gravity System:

1. Inner Pipe and Vent: Test with air at 5 psig for 4 hours or as otherwise specified in manufacturer's written instructions.

2. Outer Pipe: Test with air at 5 psig for 4 hours or as otherwise specified in manufacturer's written instructions.

L. Laboratory Gas Piping:

1. Test [ ] piping with cylinder nitrogen at [ ] psig for 24 hours.

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Test laboratory gas piping to 1.25 times operating pressure, 50 psig minimum.
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2. After test has been satisfactorily completed, temporarily reduce pressure to 5 psig with system nitrogen.

3.3 TESTING FOR HOLIDAYS:

A. Test the following buried coated steel piping systems for holidays:

1. Natural gas.

2. [List other piping systems].

B. Perform holiday test in accordance with the following procedure:

1. After pipe has been welded, joints wrapped, and pipe is ready for lowering into trench, test coating for flaws (holidays). Test coated piping system throughout its length for flaws in coating system by means of a high-potential flaw detector that can impress a maximum of 8,000 volts across coating. One electrode of tester shall maintain complete circumferential contact with coating while transversing entire length of coating system and other electrode shall be the underlying metal pipe. An electrical discharge through coating, detected visually or by instrument, shall constitute failure of this test.

   Actual working voltage of detector on pipe will depend upon thickness of coating and size of pipe. A thin coating on a large pipe will offer a capacitive load to the detector that will drop the working voltage several thousand volts below the "no-load" voltage. Detector output may also have to be increased to overcome conditions such as extremely dry rock, or sandy soil.

   Important! Do not cut ground cable to a shorter length. The length supplied is important to proper operation of the detector. Keep as much of the cable as possible in contact with the earth. Straighten out kinks where possible and do not let it ride up over skids. In dry areas it will help to drag the cable in the ditch where there is more moisture. The pipe should be grounded.

2. Mark holidays as they are found and repair prior to lowering pipe into trench. Repair holidays in factory coating by removing initial coating and undercoating for a minimum of 4 inches on each side of holiday. Remove coating around holiday and feather edge to pipe wall for sufficient distance to make a satisfactory repair. Apply primer (Polyken 1027) to the holiday to form a bond over the entire surface of the holiday and then spirally wrap pipe with a double layer of half-lapped 35 mil polyethylene tape (Polyken 934) for a minimum of 2 inches on each side of the holiday.

   Repair holidays in joint wrappings by removing field applied coating in area of holiday and rewrapping. LANL Construction Inspector or designated representative will approve all areas of joint coating.

3.4 RETESTING

A. If piping does not pass test, locate and repair leaks and repeat testing procedure until satisfactory results are obtained.

B. Make repairs to piping with new materials. Caulking on screwed joints, cracks, or holes is not acceptable.

END OF SECTION

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Do not delete the following reference information:

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FOR LANL USE ONLY

This project specification is based on LANL Master Specification 22 0813 Rev. 0, dated January 6, 2006.